



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

DECISION MEMORANDUM FOR THE SECRETARY

FROM: Anne J. Castle, Assistant Secretary – Water and Science *for*
CC: Michael L. Connor, Commissioner, Bureau of Reclamation
SUBJECT: 2011-12 Grand Canyon Protection Act Report to Congress

I. INTRODUCTION

Section 1804 of the Grand Canyon Protection Act of 1992 requires the Secretary to transmit to the Congress and to the Governors of the Colorado River Basin States a report on the preceding year and the projected year operations undertaken pursuant to this Act. This Report provides an update from the last report submitted by the Department on April 27, 2012 and covers activities for the five Interior agencies having responsibilities under the Grand Canyon Protection Act--the Bureau of Indian Affairs (BIA); the Bureau of Reclamation; the National Park Service (NPS); the United States Geological Survey (USGS); and the United States Fish and Wildlife Service (FWS)--for 2011 and 2012.

II. BACKGROUND

This report addresses operations by the above five agencies for 2011 and proposed operations for 2012. The major events described in the Report were the signing of Records of Decisions (RODs) for Glen Canyon High Flow Event (HFE) Protocol, and the Control on Non-native Fish below Glen Canyon Dam. The HFE Protocol allows Reclamation to conduct an HFE when the conditions in the river warrant it, during windows of opportunity in the spring and fall. The HFE is designed to enhance habitat in the canyon, and rebuild and maintain sandbars and beaches. Control of non-native fish below Glen Canyon Dam is necessary for the preservation of the native humpback chub. Non-native species compete with and prey on this endangered species.

III. POSITION OF INTERESTED PARTIES

None of the other stakeholders have expressed a strong opinion regarding this report.

III. DECISION OPTIONS

The Report to Congress is statutorily required. No separate decision is necessary.

IV. RECOMMENDATION

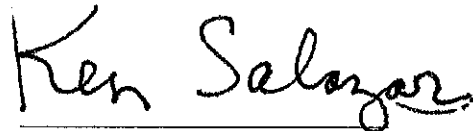
We recommend that the Secretary approve transmittal of the Report to Congress as required by the Grand Canyon Protection Act.

V. SECRETARY'S DECISION

☒ APPROVE

☐ DISAPPROVE

☐ COMMENTS



Ken Salazar



THE SECRETARY OF THE INTERIOR
WASHINGTON

AUG 10 2012

The Honorable Gary Herbert
Governor of Utah
Salt Lake City, Utah 84114

Dear Governor Herbert:

The enclosed Report on the operation of Glen Canyon Dam by the Department of the Interior (Interior) is submitted pursuant to section 1804 of the Grand Canyon Protection Act of 1992, which provides:

Each year after the date of the adoption of criteria and operating plans pursuant to paragraph (1), the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report, separate from and in addition to the report specified in section 602(b) of the Colorado River Basin Project Act of 1968 on the preceding year and the projected year operations undertaken pursuant to this Act.

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Interior continues to closely monitor conditions in the Colorado River Basin and looks forward to continuing to work with the Congress and other interested stakeholders regarding the management of this vital component of the Colorado River system.

Sincerely,

Ken Salazar

Enclosures

Identical Letters Sent To:

The Honorable Jeff Bingaman
Chairman, Committee on Energy
and Natural Resources
United States Senate
Washington, DC 20510

The Honorable Brian Sandoval
Governor of Nevada
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The Honorable Jerry Brown
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The Honorable Jerry Brown
Governor of California
Sacramento, California 95814

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WASHINGTON

AUG 10 2012

The Honorable John Hickenlooper
Governor of Colorado
Denver, Colorado 80203

Dear Governor Hickenlooper:

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AUG 10 2012

The Honorable Matt Mead
Governor of Wyoming
Cheyenne, Wyoming 82002

Dear Governor Mead:

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AUG 10 2012

The Honorable Susanna Martinez
Governor of New Mexico
Santa Fe, New Mexico 87501

Dear Governor Martinez:

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AUG 10 2012

The Honorable Jan Brewer
Governor of Arizona
Phoenix, Arizona 85007

Dear Governor Brewer:

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REPORT TO CONGRESS
OPERATIONS OF GLEN CANYON DAM
PURSUANT TO THE GRAND CANYON PROTECTION ACT OF 1992
FOR
2011-2012

Secretary of the Interior

August 2012

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EXECUTIVE SUMMARY

This Report by the Department of the Interior (Interior) is submitted pursuant to section 1804 of the Grand Canyon Protection Act (GCPA) of 1992, which provides:

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INTRODUCTION

Glen Canyon Dam (Dam) was authorized for construction by the Colorado River Storage Project Act of 1956, 43 U.S.C. § 620. The Dam was completed in 1963 and is operated by the Bureau of Reclamation (Reclamation). In 1992, Congress enacted the GCPA, which requires the Secretary of the Interior (Secretary) to operate Glen Canyon Dam:

[i]n accordance with the additional criteria and operating plans specified in section 1804 and exercise other authorities under existing law in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use.

Congress also directed that such operations be undertaken:

in a manner fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in Arizona vs. California, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River Basin.

In 1997, the Secretary established the Glen Canyon Dam Adaptive Management Program (GCDAMP) to carry out the requirements of the GCPA. As part of the GCDAMP, the Secretary also established the Adaptive Management Work Group (AMWG), a 25-member Federal Advisory Committee that operates pursuant to the provisions of the Federal Advisory Committee Act, 5 U.S.C. § App. 2. The Secretary's Designee, currently Assistant Secretary for Water and Science, Anne Castle, serves as the Chair of the AMWG.

STATUS REPORT

The Interior has five agencies that participate in the GCDAMP and undertake operations and other activities as part of Interior's actions pursuant to the GCPA; the: (1) Bureau of Indian Affairs (BIA); (2) Reclamation; (3) National Park Service (NPS); (4) United States Geological Survey (USGS); and (5) United States Fish and Wildlife Service (FWS). The Western Area Power Administration (Western) also has statutory responsibilities pursuant to the Department of Energy Organization Act, Flood Control Act, Reclamation Project Act, Colorado River Storage Project Act, and GCPA. The role of each responsible Interior agency under the GCPA is briefly addressed below.

Bureau of Indian Affairs

The BIA's mission, among other objectives, includes enhancing quality of life, promoting economic opportunity, and protecting and improving trust assets of Indian tribes and individual American Indians. This is accomplished within the framework of a government-to-government relationship in which the spirit of Indian self-determination is paramount. As part of the AMWG, the BIA works hand-in-hand with interested tribes and other participating agencies to ensure that this fragile, unique, and traditionally important landscape is preserved and protected.

Bureau of Reclamation

Reclamation operates Glen Canyon Dam in accordance with and subject to interstate compacts, an international treaty, Federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the "Law of the River", additional criteria and operating plans specified in section 1804 of the GCPA, and approved experimental plans.

National Park Service

The NPS manages units of the national park system and administers resource related programs under the authority of various Federal statutes, regulations, and executive orders, and in accordance with written policies set forth by the Secretary and the Director of the NPS, including the NPS Management Policies 2006 and the NPS Director's Orders. The NPS manages Grand Canyon National Park and Glen Canyon National Recreation Area under the NPS Organic Act, 16 U.S.C. §§ 1 and 2-4, as amended; other acts of Congress applicable generally to units of the national park system; and the legislation specifically establishing those park units; 16 U.S.C. §§ 221-228j and 16 U.S.C. §§ 460dd through 460dd-9 (2006). The NPS Organic Act directs the NPS to "promote and regulate the use of . . . national parks . . . in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The NPS helps the Secretary achieve the goals outlined in the GCPA through its resource management and resource monitoring activities.

U.S. Geological Survey

The Grand Canyon Monitoring and Research Center (GCMRC) of the USGS was created to fulfill the mandate in the GCPA for the establishment and implementation of a long-term monitoring and research program for natural, cultural, and recreation resources of Grand Canyon National Park and Glen Canyon National Recreation Area. The GCMRC provides independent, policy neutral scientific information to the GCDAMP on (a) the effects of the operation of Glen Canyon Dam and other related factors on resources of the Colorado River ecosystem using an ecosystem approach, and (b) the flow and non-flow measures to mitigate adverse effects. The GCMRC's activities are focused on (a) monitoring the status and trends in natural, cultural, and recreational resources that are affected by dam operations, and (b) working with land and resource management agencies in an adaptive management framework to carry out and evaluate the effectiveness of alternative dam operations and other resource conservation actions described in this Report.

Fish and Wildlife Service

The FWS provides Endangered Species Act (ESA) conservation and associated consultation and recovery leadership with various stakeholders primarily to benefit four listed species: the humpback chub (*Gila cypha*), razorback sucker (*Xyrauchen texanus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and Kanab ambersnail (*Oxyloma haydeni kanabensi*). The FWS provides Fish and Wildlife Coordination Act (FWCA) planning assistance for important fish and wildlife resources whenever waters of the Colorado River or its tributaries are controlled or modified for conservation.

2011 OPERATIONS

Bureau of Indian Affairs

The BIA continued to support the tribes in their funding requests for various projects, participated in consultation meetings with the tribes regarding the Tribal Consultation Plan, conducted pre-meetings with tribal representatives prior to AMWG meetings, and participated in ad hoc groups and other meetings regarding cultural and natural resources issues and concerns. The BIA provided funding to the tribes for their participation in the GCDAMP. In Fiscal Year 2011, the BIA served as a Cooperating Agency for Reclamation's two Environmental Assessments (EA's) (High Flow Experimental Protocol and Non-Native Fish Control); participated on the Interior Native American Core Team and various GCDAMP Ad Hoc Groups; and reviewed the development of the hydrograph for the Annual Operating Plan (AOP) and GCDAMP efforts. The BIA will also be a Cooperating Agency on the Long Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS) process. Other activities included the Programmatic Agreement for cultural resources and continued coordination efforts for tribal participation in the GCDAMP.

Bureau of Reclamation

As in 2010, a 2011 hydrograph was jointly developed by the Interior AMWG agencies and Western. The recommended hydrograph was consistent with the Law of the River (including the GCPA) and was designed to enhance protection of downstream resources. This approach to operations does not modify the Interim Guidelines, operating criteria, or 2007 Record of Decision (ROD), and falls within the parameters of the modified low fluctuating flows (MLFF) alternative adopted in the 1996 ROD. The recommended hydrograph received broad support from the members of AMWG, and was approved by the Secretary on September 21, 2010.

Releases from Lake Powell in Water Year (WY) 2011 continued to reflect consideration of the uses and purposes identified in the authorizing legislation for Glen Canyon Dam and were consistent with the 1996 ROD and the 2008 EA/Finding of No Significant Impact for Experimental Releases for Glen Canyon Dam, Arizona, 2008-2012. The actual monthly release volumes for WY 2011 are displayed in Table 1. A steady flow regime (steady daily releases), as described in the Experimental Releases EA, was implemented in September 2010 (as well as during the first month of the 2011 Water Year, October 2010). These steady releases were 8,000 cfs during these 2 months.

**Table 1. Actual Lake Powell Monthly Release Volumes
Water Year 2011**

Month	Monthly Release Volumes (maf)
October 2010	0.495
November 2010	0.810
December 2010	0.847
January 2011	0.997
February 2011	0.964
March 2011	1.033
April 2011	0.940
May 2011	1.171
June 2011	1.377
July 2011	1.483
August 2011	1.479
September 2011	0.922
Total Releases	12.518

On December 10, 2009, Secretary Ken Salazar announced that Interior would initiate development of a High-Flow Experimental Protocol for releases from Glen Canyon Dam as part of the ongoing implementation of the GCDAMP. The high-flow experimental (HFE) releases have been undertaken in the past and will be further analyzed and implemented pursuant to the direction of the Secretary. In order to assess the ability of such releases to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. As part of the GCDAMP, Interior's effort to develop the High Flow Experimental Protocol is a component of its ongoing responsibility to comply with the requirements and obligations established by the GCPA of 1992 (Pub. L. 102-575). The High-Flow Experimental Protocol EA was published on December 30, 2012, and the

Record of Decisions will be published soon. The GCDAMP Federal agencies, Hopi Tribe, Hualapai Tribe, Zuni Pueblo, the Arizona Game and Fish Department (AZGFD), and Upper Colorado River Commission were cooperating agencies in the process. A copy of the High-Flow Experimental Protocol EA may be found at www.usbr.gov/uc/envdocs/ea/gc/HFEProtocol.

Along with the High-Flow Experimental Protocol EA, Reclamation began an EA on Non-Native Fish Control in 2010 that was also released on December 30, 2011, with the Record of Decision expected to be completed soon. The Non-Native Fish Control EA will evaluate alternatives for controlling non-native fish species that prey on and compete with native fishes including the endangered humpback chub. The Non-Native Fish Control is an important requirement and conservation measure of the FWS December 23, 2011 Biological Opinion (BO) on the High-Flow Experimental Protocol and Non-Native Fish Control EAs. The GCDAMP Federal agencies, Zuni Pueblo, Hualapai Tribe, and the AZGFD were cooperating agencies in this process. A copy of the Non-Native Fish Control EA, including the December 23, 2011 BO, may be found at www.usbr.gov/uc/envdocs/ea/gc/nnfc.

Reclamation continues to conduct government-to-government consultation with Native American tribes as part of the GCDAMP on operations of Glen Canyon Dam and activities of the GCDAMP in services of its responsibilities, including those under section 106 of the NHPA, Executive Order 13175, Secretarial Order 3206, and the November 5, 2009, Presidential Memorandum on Tribal Consultation.

National Park Service

In 2011, Grand Canyon National Park provided significant support to the overall goals outlined in the GCPA as described herein.

Archaeological/Cultural Resources

The NPS opened its exhibit entitled "Grand Archaeology" at Kolb Studio on the South Rim of the Grand Canyon on April 30, 2011. The exhibit details the results of archaeological excavations undertaken at nine sites along the Colorado River. The exhibit can be visited on-line through the NPS or the Grand Canyon Association website and will be on exhibit at the Museum of Northern Arizona from October 2011 through August 2012.

The NPS completed a final draft of the Colorado River Management Plan (CRMP) monitoring protocols and distributed them for peer (including tribal) review. The NPS continued development of a draft of the CRMP mitigation protocols. That document was sent for review in fall 2011. The NPS is currently working with a cooperator to develop a best practices manual for use of check dams for erosion control on archaeological sites. The NPS monitored 15 sites within the CRMP project corridor in FY 2011.

At Grand Canyon National Park, GCMRC began plans for working with the NPS on evaluating the utility of aerial imaging for determining changes in ground cover at a select group of archaeological sites. This pilot program will be designed to test various change detection

methodologies and include tribal evaluation of utility of remote sensing for long-term monitoring.

Tribal Consultation

In 2011, the NPS continued to participate in consultation meetings with the various tribes who are directly involved in the GCDAMP and other Colorado River related programs.

The Grand Canyon NPS staff initiated discussions with interested tribes on incorporating tribal perspectives into the NPS Fish Management Plan. Staff worked with other Interior agencies in support of consultation efforts on the Non-Native Fish Control Project. The tribal advisors were consulted on specific monitoring and mitigation protocols relative to CRMP implementation. Final protocols are expected by the end of 2011. The NPS staff accompanied Pueblo of Zuni cultural specialists and religious advisors on their river monitoring trip in August 2011. Results from the discussions will be incorporated into ongoing programs.

Humpback Chub Translocation and Fisheries Management

In 2011, the NPS continued to coordinate with the FWS, Reclamation, University of Missouri, AZGDF, and GCMRC on humpback chub translocations in Shinumo Creek. The translocation effort was expanded to Havasu Creek with the first of three planned translocations.

Translocation success-monitoring continued in both Shinumo and Havasu Creeks and knowledge gained will be used to develop long-term management objectives to be included in the NPS led Fish Management Plan. The Plan, expected to be completed in late 2012, is designed to address management of native fish within Grand Canyon National Park and Glen Canyon National Recreation Area (including the Lees Ferry area). The work at Bright Angel Creek to remove trout continued in 2011 and food base studies were undertaken through the University of Missouri.

Wildlife Surveys and Monitoring

In 2011 surveys continued for the southwestern willow flycatcher, Northern goshawk, and other migratory birds. The California condor nest monitoring also continued in coordination with the Peregrine Fund. A desert bighorn sheep genetic study commenced in conjunction with the Biological Resources Management Division. Mountain lion research continued both on the rims and inner canyon and included radio tracking and kill site investigation.

In 2011, Grand Canyon National Park staff continued to work under the direction of the CRMP in implementing restoration projects at priority sites and also expanded plant collection and propagation efforts in preparation for larger watershed restoration projects. In the river corridor, staff continued to focus efforts on removing high priority invasive plant species, with over 36,500 individual plants removed by staff and volunteers. The NPS staff coordinated a pilot program this year working with commercial river guides, NPS boatmen, Grand Canyon Youth, other organized groups, and individuals to systematically control camelthorn and Russian thistle at 10 pre-selected campsites; participant feedback and project results indicate success. The NPS staff collaborated with University of Arizona and Northern Arizona University to inventory and document the presence of the northern tamarisk beetle (*Diorhabda carinulata*), a biological

control agent for tamarisk, in the river corridor and to measure the levels of tamarisk defoliation; results will be used for future watershed restoration planning.

Research Review and Permitting

The Grand Canyon National Park's research office continued to have one of the largest research and collection permitting programs within the NPS. Over 120 researchers are listed as either principal or co-principal investigators presiding over current studies. In 2011, the annual number of river trip applications under the GCDAMP dropped to 15, the lowest number in years. The reduction is due, in part, to efficient combinations of projects on each river trip, resulting in fewer river trips overall. The GCMRC was issued 8 research and collection permits and 10 stand alone river permits, totaling 2,972 river user days. For each of these GCMRC permits, assistance was provided to the Principal Investigator in completing the Minimum Requirement Analysis (MRA) and related compliance documents. In addition, 5 tribal research permits with corresponding river trips were permitted for the Hopi, Hualapai, Navajo, Paiute, and Zuni tribes, totaling 1,013 river user days. Overall 3,985 user days were spent on the river conducting GCDAMP related research in disciplines such as sediment storage and morphology, nearshore ecology, mainstem Colorado fish monitoring, and tribal cultural monitoring.

Outside of the GCDAMP, the research office continued to review proposals, coordinate efforts, and provide permitting guidance as needed for all GCPA projects in 2011. An additional 37 research permits were issued to independent or university researchers and logistical planning was provided to various disciplines including vegetation baseline monitoring, geomorphology, terrestrial remote sensing, and soundscape monitoring.

Resource Monitoring and Mitigation

The NPS discontinued data collection in 2011 in order to complete analysis and review of the protocols and methods. The team concentrated on mapping campable area of campsites to determine changes resulting from equalization flows. One mitigation trip was conducted in the Lower Gorge area to work on five campsites. A second trip occurred in November 2011 that completed work on 10 campsites in partnership with Grand Canyon river outfitters.

Watershed Restoration Program

In 2011, the NPS, in partnership with Northern Arizona University via a Cooperative Ecosystem Studies Unit agreement, initiated analysis of its CRMP monitoring data collected from 2007-2010 to assess the effects of recreation and other factors on natural resources at 66 river camps in Grand Canyon National Park. The NPS, in partnership with Grand Canyon Association via funding from the Pulliam Charitable Trust and Concession Franchise Fees, initiated planning for a pilot riparian stewardship project at Granite Camp and Monument Creeks along the Colorado River. The NPS and partners (incl. FWS, USGS, AZGFD) initiated a feasibility study for reintroducing Northern Leopard Frogs into its historic range within Grand Canyon National Park and Glen Canyon National Recreation Area.

U.S. Geological Survey

Resource Monitoring

During 2011, the Interior approved work plan and budget for the GCMRC supported monitoring and research activities aimed at meeting the GCDAMP's resource information needs. A major focus was on continuing to monitor status and trends of native and non-native fish and refining approaches for monitoring Glen Canyon Dam effects on other downstream resources of concern to the GCDAMP, such as fish, the aquatic food base, camping areas and archaeological sites. The GCMRC collaborated with the GCDAMP Technical Workgroup (TWG) to finalize the GCMRC's General Core Monitoring Plan and forwarded a recommendation to the AMWG for approval of the overall design and process for implementing all monitoring projects.

High Flow Experiment Synthesis

In February 2011, the GCMRC published a report that summarizes and synthesizes experimental results from the 1996, 2004, and 2008 HFEs. This Report, USGS Circular 1366 "Effects of Three High Flow Experiments in the Colorado River Ecosystem Downstream from Glen Canyon Dam, Arizona" also outlines a strategy for triggering future HFEs, intended to rebuild and maintain sandbars and related habitats below the dam, on the basis of sand inputs supplied from tributary sources below the dam. The GCMRC also used information derived from the above report and other peer reviewed sources to assist Interior and its management agencies in the development of a science-based High Flow Experimental Protocol for Glen Canyon Dam.

Near-shore Ecology and Fall Steady Flow Study

The 4th year of the 5-year near shore ecology and Fall Steady Flow (September and October) experimental study continued to evaluate the effects of fall steady flows on juvenile humpback chub. In addition, this study is investigating the importance of various near shore habitats to juvenile humpback chub.

Socio-Economics Expert Panel Review

In 2011, the GCMRC worked with Western to organize a workshop to review appropriate power economic models for use in evaluating economic impacts to power from alternative operating regimes. The GCMRC staff participated in numerous meetings of the Socioeconomic Ad Hoc Group of the GCDAMP to review and respond to recommendations that were originally developed by an expert panel of economists at a December 2009 workshop concerning the need for additional socioeconomic research to inform decisions of the GCDAMP.

Non-Native Fish Management Reporting

The GCMRC finalized a 2011 USGS Report that summarizes known methods for capturing and removing non-native fishes found in the Colorado River in Grand Canyon. This Report was one outcome of a workshop convened in 2010 and includes recommendations for additional research

that would support improving the status of knowledge of these species, an important precursor to assessing the risk that they may pose to native fishes in the system.

Knowledge Assessment

A key element of the collaborative science planning process outlined in the 2007-2011 Strategic Science Plan (SSP) (USGS 2007) and the Monitoring and Research Plan (MRP) (USGS 2007) is a synthesis at 5-year intervals of new science information in an updated Knowledge Assessment. The Knowledge Assessment is a critical part of the adaptive management process that is needed to inform the review and revision of the GCDAMP Strategic Plan and the 2012-2017 SSP and MRP. The 2011 Knowledge Assessment summarized and evaluated new information regarding status and trends of GCDAMP resources and responses of those resources to various experimental treatments for use by managers, stakeholders and scientists as they consider new directions for the GCDAMP. As in 2005, knowledge assessment workshops were convened by the GCMRC staff, science cooperators, and stakeholders to evaluate progress made over the last 5-years relative to flow and non-flow experimental treatments across all resources of interest to the GCDAMP and Interior. The outcome of the knowledge assessment is intended to be documented through a combination of reports and dissemination of information through the world-wide-web as well as summaries incorporated into the GCMRC's next 5-year monitoring and research plan (2013-17).

Science Support to Department of the Interior Management Agencies

The GCMRC continued to provide science support to the development on the EAs for Non-Native Fish Removal and development of a High Flow Experimental Protocol. The EAs, led by Reclamation, are expected to be completed in the first quarter of 2012. In addition, the GCMRC will actively provide science support to the LTEMP EIS which is to be initiated by Interior in 2012.

Other Reporting

The GCMRC published approximately 25 to 30 new monitoring and research reports in 2011, as well as several new USGS fact sheets. Another USGS report, Open-File Report 2011-1220 "Summary report of responses of key resources to the 2000 Low Steady Summer Flow experiment, along the Colorado River downstream from Glen Canyon Dam, Arizona," was also published.

Tribal Consultation

The GCMRC continued previous efforts to achieve more meaningful consultation with the Tribes on science issues related to GCMRC monitoring and other related 2011 work plan activities. These efforts included working with other Interior agencies and the new Interior tribal liaison to develop a protocol for coordinating tribal consultation efforts for all projects associated with the GCDAMP.

Youth Education

In cooperation with NPS and Grand Canyon Youth (GCY), the GCMRC led two research and monitoring trips during summer 2011. These trips helped the GCMRC and the NPS meet the science of the GCDAMP while also providing educational outreach to the GCY organization.

Fish and Wildlife Service

In 2011, the FWS worked with the GCMRC, BIA, Reclamation, NPS, and other GCDAMP stakeholders to further support conservation for humpback chub, including responses to Court Orders and recent biological opinions. The FWS worked with Reclamation to complete necessary compliance for HFEs and Non-Native Fish Control. The FWS provided information to the AMWG regarding interest in developing a Recovery Implementation Program (RIP) for endangered native fish in the Lower Colorado River, including the humpback chub in Marble and Grand Canyons in a habitat based approach.

The FWS conducted seven monitoring trips in the Little Colorado River as well as led a trip that sampled the nine aggregations of humpback chub in the mainstem Colorado River. A translocation of humpback chub to Chute Falls took place in July 2011, along with collections to maintain the Dexter National Fish Hatchery and Technical Center (NFH&TC) refuge population and fish for 2012 translocations into Havasu Creek. The FWS continued working as co-leads with the NPS and the Havasupai Tribe for planning and monitoring studies in Havasu Creek for a continued humpback chub translocation in 2012. The FWS worked with the GCMRC and other partners to analyze and implement the recommendations of the recent GCDAMP Fisheries Monitoring Protocol Evaluation Panel. Removal of non-native fish will continue to be reviewed to assess the potential need to reduce rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus melas*), or other predatory non-native fish populations in the general area of the confluence of the Little Colorado River and mainstem of the Colorado River. The assessment will include recognition of the concerns expressed by the Zuni Pueblo and other tribes about the lethal removal of non-native fish from Grand Canyon, and will evaluate the feasibility of moving mechanical control work to other areas that reduce detrimental impacts to tribal values.

The FWS worked with the GCMRC to develop new ways to mark small humpback chub using elastomer tags so that population estimates can be generated on young of year fish in the Little Colorado River. The FWS worked with the NPS to develop new ways of collecting fish, including investigating methods for larval collections, for the different translocation projects that minimize the impacts on larger fish and decrease handling time.

The FWS continued to work with Reclamation as lead in conducting consultations with interested tribes in regard to Non-Native Fish Control and other related matters. Specifically, the FWS, as a Cooperating Agency, assisted Reclamation in development of two EAs: High-Flow Experimental Protocol and Non-Native Fish Control. The FWS continued to assist on work efforts of the AMWG and its TWG and Ad Hoc Groups.

The FWS worked with the AZGFD to implement monitoring and conservation actions for the Kanab ambersnail within the Grand Canyon National Park. The FWS worked to accomplish other management actions as determined appropriate within the GCDAMP with the stakeholders to conserve humpback chub and other endangered species in support of the ESA. Further, the FWS in coordination with the AZGFD worked within the GCDAMP and others to provide for conservation of endangered species, Lees Ferry trout fishery, neotropical songbird riparian habitats, and other fish and wildlife resources in support of the FWCA within limits of funding availability.

2012 OPERATIONS

Bureau of Indian Affairs

The BIA will continue to consult with the tribes on formulating funding requests for various projects related to the adaptive management program. The BIA additionally will participate in numerous consultation meetings with the tribes regarding the Tribal Consultation Plan, conduct pre-meetings with tribal representatives prior to the AMWG meetings, and participate in ad hoc groups and other meetings regarding cultural and natural resources issues and concerns. The BIA continued to provide its portion of funding to the tribes for their participation in the GCDAMP. In Fiscal Year 2012, the BIA will continue to serve as a Cooperating Agency for Reclamation's two EA's (High-Flow Experimental Protocol and Non-Native Fish Control); participate on the Interior Native American Core Team and various GCDAMP Ad Hoc Groups; and review the development of the hydrograph for the AOP and GCDAMP efforts. The BIA will also be a Cooperating Agency on the Long Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS) process. Other activities will include participating in development of the Memoranda of Agreement for cultural resources and continued coordination efforts for tribal participation in the GCDAMP.

Bureau of Reclamation

As in 2010 and 2011, a 2012 hydrograph was jointly developed by the Interior AMWG agencies and Western. The recommended hydrograph was consistent with the Law of the River (including the GCPA) and was designed to enhance protection of downstream resources. This approach to operations does not modify the Interim Guidelines, operating criteria, or 2007 ROD, and falls within the parameters of the MLFF alternative adopted in the 1996 ROD. The recommended hydrograph received broad support from the members of the AMWG, and was approved by the Secretary on December 5, 2011.

Releases from Lake Powell in WY 2012 will continue to reflect consideration of the uses and purposes identified in the authorizing legislation for Glen Canyon Dam and will be consistent with the 1996 ROD, the 2008 EA/Finding of No Significant Impact for Experimental Releases for Glen Canyon Dam, Arizona, 2008-2012 and the 2012 hydrograph. The projected monthly release volumes for WY 2012 based on the January 24-Month Study is displayed in Table 2. A steady flow regime (steady daily releases), as described in the Experimental Releases EA, was implemented in September 2011 (as well as during the first month of the 2012 water year, October 2011). These steady releases were approximately 15,500 cfs during these 2 months.

The January 2012 projection for steady release for September 2012 is 8,000 cfs and projected end of water year elevation for Lake Powell is 3,643 feet. These projections are subject to modification in response to actual hydrologic conditions as the water year progresses.

**Table 2. Projected Lake Powell Monthly Release Volumes
Water Year 2012**

Month	Monthly Release Volumes (maf)
October 2011*	0.956
November 2011*	1.099
December 2011*	1.223
January 2012*	0.852
February 2012*	0.653
March 2012*	0.600
April 2012*	0.606
May 2012*	0.601
June 2012*	0.709
July 2012	0.888
August 2012	0.800
September 2012	0.476
Total Projected Releases	9.463

*Actual releases

Interior published a final EA on development of a High-Flow Experimental Protocol for releases from Glen Canyon Dam on December 30, 2011, and a decision on the EA was issued in May 2012. The High-flow experimental releases have been undertaken in the past and have been further analyzed to assess whether such releases will protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. The GCDAMP Federal agencies, Hopi Tribe, Hualapai Tribe, Zuni Pueblo, AZGFD, and Upper Colorado River Commission are cooperating agencies in the process. A copy of the High-Flow Experimental Protocol EA may be found at www.usbr.gov/uc/envdocs/ea/gc/HFEProtocol. Along with the High-Flow Experimental Protocol EA, Reclamation began an EA on Non-Native Fish Control in 2010 that was finalized on December 30, 2011. The decision on the EA was issued in May 2012. The Non-Native Fish Control EA evaluated alternatives for controlling non-native fish species that prey on and compete with native fishes including the endangered humpback chub. The Non-Native Fish Control is an important requirement and conservation measure of a biological opinion received from the FWS dated December 23, 2011. A copy of the Non-Native Fish Control EA, including the December 23, 2011 BO, may be found at www.usbr.gov/uc/envdocs/ea/gc/nmfc.

In July 2011, Reclamation and the National Park Service published a Notice of Intent to prepare an Environmental Impact Statement (EIS) for the proposed Long Term Experimental and Management Plan (LTEMP). Public scoping meetings were conducted in November 2011, and the public scoping comment period ended on January 31, 2012. Interior is currently developing proposed alternatives, and held a public meeting in Flagstaff, AZ on April 4, and 5, 2012.

Reclamation continues to conduct government-to-government consultation with American Indian Tribes as part of the GCDAMP on operations of the Glen Canyon Dam and activities of the GCDAMP in services of its responsibilities, including those under section 106 of the NHPA, Executive Order 13175, Secretarial Order 3206, and the November 5, 2009, Presidential Memorandum on Tribal Consultation.

National Park Service

Archaeological/Cultural Resources

Field work in 2012 will consist of condition assessment monitoring at 100 sites along the Colorado River. Sites with check dams will be monitored and maintained to ensure continued site stability. Currently 29 sites along the river have check dams as a treatment to curtail or minimize additional erosion. Field staff will work to install monitoring points at a selection of sites with extensive artifact scatters to test protocols for visitor impacts. Ground Penetrating Radar (GPR) will be used to conduct subsurface mapping at six river corridor sites. This project is a pilot project to determine if GPR is an appropriate and effective management tool for prioritizing data recovery treatment recommendations. An additional project using aerial imagery from the GCMRC will identify the presence of disturbed sediments in the lab and field staff will then ground truth this data to determine if change detection using aerial imagery is possible using a 4-year time scale.

Data recovery is scheduled for one site adjacent to a major river and backpacker camp in conjunction with the Watershed Stewardship program. The archaeological site contains five prehistoric features including hearths and a possible subterranean pit structure. This project is intended to add to our expanding knowledge of using the river corridor during the transition to more intensive agricultural practices.

Mitigation and management protocols are also scheduled to be completed for the Colorado River Management Plan cultural resource program. These protocols may be used by the upcoming Back country management plan currently being drafted by the NPS.

Tribal Consultation

In 2012, the NPS will continue to participate in consultation meetings with the various tribes who are directly involved in the GCDAMP and other Colorado River related program. The Grand Canyon National Park staff will continue discussions with tribes to incorporate tribal perspectives into the NPS Fish Management Plan, expected to be completed in 2012. Tribal advisors were consulted on specific monitoring and mitigation protocols relative to the CRMP implementation. Final protocols were distributed for tribes for review and should be finalized in early 2012.

The NPS will work with BOR to consult with interested tribes in the LTEMP. Consultation is expected to be both government-to-government and with tribes as Cooperating Agencies for the EIS.

Humpback Chub Translocation and Fisheries Management

In 2012, the NPS (Grand Canyon National Park and Glen Canyon National Recreation Area) will complete a comprehensive fish management plan to address management of native fish within Grand Canyon National Park and sport fish management in the Lees Ferry area of Glen Canyon National Recreation Area. The Bright Angel Creek non-native fish removal efforts will be continued and expanded, and translocations and/or associated monitoring will be continued in Havaasu and Shinumo creeks.

Wildlife Surveys and Monitoring

In 2012 activity will be similar to that undertaken in 2011 concerning the southwestern willow flycatcher, California condor, Northern goshawk, and desert bighorn sheep genetic study. Mountain lion research will also continue on both of the rims and inner-canyon including radio tracking and kill site investigation.

Vegetation Management/Exotic Species Removal

In 2012, Grand Canyon National Park staff will continue to implement priority sites, and will expand plant collection and propagation efforts in preparation for watershed restoration projects. Restoration biologists will finalize the Backcountry Restoration Handbook, a comprehensive document that contains protocols and methods for site restoration along the river corridor. Staff and volunteers will continue to document and remove high priority invasive plant species from the river corridor and will continue to expand hands-on stewardship opportunities. Staff will continue to work with partners to document northern tamarisk beetle (*Diorhabda carinulata*) presence and tamarisk defoliation in the river corridor and will ensure that the results are readily available to the public.

Research Review and Permitting

The NPS anticipates continuation of research and permitting activities in 2012 at similar levels as 2011. For each of the research projects in support of the Grand Canyon Protection Act, peer review of the proposals, evaluation of need for NEPA and completion of Minimum Requirement Analysis (MRA) will be completed. Updating of annual investigator reports will be done for each research permit and coordination with Reclamation will continue.

Resource Monitoring and Mitigation

The NPS will continue integrated campsite monitoring in 2012 to include mapping of campable area and evaluate changes due to 2011 equalization flows. The NPS will conduct campsite use surveys and attraction site monitoring. Two mitigation trips are planned to concentrate on campsite impacts in areas above the 25,000 cfs flow line and pre-dam highwater areas. This work will be completed in cooperation with the Grand Canyon outfitters and the Grand Canyon Private Boater's Association.

Watershed Restoration Program

In 2012, an interdisciplinary team of NPS experts, agency partners, scientists, and other groups and individuals will continue to conduct a Greater Grand Canyon Landscape Assessment in an effort to identify and prioritize conservation needs and management strategies and ensure ecosystem-based stewardship. The NPS expects to complete its analysis of Colorado River Management Plan Monitoring data and utilize the results to modify future monitoring methods and management. The NPS will initiate a site assessment and on the ground stewardship activities at Granite Camp and Monument Creeks along the Colorado River and plans to initiate field assessments of potential suitable habitat for Northern Leopard Frogs.

U.S. Geological Survey

Knowledge Assessment Synthesis

As follow up to four expert knowledge assessment workshops held in 2011, the GCMRC convened two synthesis workshops with the technical workgroup of the GCDAMP in October 2011 and January 2012. The objective of these workshops was to more effectively communicate to and educate stakeholders about the learning that experts had identified during the 2011 meetings. These workshops also allowed technical workgroup members opportunities to discuss new findings with the GCMRC staff prior to development of the FY 2013-14 biennial work plan for monitoring and research of the Colorado River ecosystem below the Glen Canyon Dam.

Aquatic Resources – An October 2011 workshop hosted by GCMRC focused on new information about native and non-native fisheries and the food base, while a January 2012 workshop was planned to focus primarily on sediment and related resources as well as advances made in streamflow and sediment transport modeling since 2005. During the October 2011 workshop, scientists described a system-wide increase in native fish populations, including endangered humpback chub, which has been observed since the early 2000s (Makinster et al. 2011; Makinster et al. 2010; Coggins and Walters 2009). The current estimate indicated the humpback chub population includes between 7,500 and 10,000 adult fish (Coggins and Walters 2009). A concurrent decrease in non-native trout populations was observed until about 2007 (Makinster et al. 2010). The native fish response is thought to be related to warmer mainstem temperatures since about 2003 and the post 2000 decline in non-native fish.

Recently, significant increases in trout abundance have been associated with individual flow experiments and the Modified Low Fluctuating Flow (MLFF) flow regime, including the 2008 High Flow Experiment (Korman et al. 2011; Korman and Melis 2011), fall steady flow testing in September and October 2008-11, and high, steady equalization flows released from Glen Canyon Dam in 2011 (see Table 1, Actual Lake Powell Monthly Release Volumes Water Year 2011, above). Despite increases in rainbow trout densities, the apparent survival rates of juvenile humpback chub in the mainstem near the Little Colorado River confluence have not declined (GCMRC, unpublished data). The Juvenile humpback chub in this reach have also been shown to use a variety of habitats generally in proportion to their availability. An exception was nearshore backwater habitat which, when available, was selected for disproportionately (GCMRC, unpublished data). It is important to note, however, that backwaters make up only a small portion of available habitats in this study reach and juvenile humpback chub survival rates did not decline when these areas were unavailable.

All fish populations throughout the Colorado River downstream of the Glen Canyon Dam appear to be limited by the availability of high-quality food resources (Donner 2011). Two types of aquatic insects—black flies and midges—appear to be particularly important food resources for fish populations, because annual consumption of these insects by fish closely matches independent estimates of their availability (Cross et al. 2011, Donner 2011). Both rainbow trout and brown trout diets also include fish (Yard et al. 2011). The brown trout have a much higher incidence of fish in their diets than rainbow trout, but rainbow trout are much more common likely resulting in a greater cumulative effect. Of the fish consumed by both trout species, disproportionate amounts are made up of native fishes (Yard et al. 2011).

Sediment and Related Resources - Sediment monitoring has revealed that a decade of MLFF Glen Canyon Dam Operations associated with below average annual releases from Lake Powell (Water Years 2001-2010 were all 8.23 million acre foot releases except for slightly higher volume in water 2008) had minimal net effect on the amount of sand in Marble and Grand Canyons through 2010. However, the much higher equalization release operations during Water Year 2011 (12.5 million acre-feet, see Table 1, Actual Lake Powell Monthly Release Volumes Water Year 2011, above), resulted in erosion of about 1.6 million metric tons of sand from Marble Canyon and about 1.9 million metric tons of sand from eastern Grand Canyon. To place this amount of erosion in context, and given the rate at which sand was supplied by the Paria and Little Colorado Rivers during the last decade, if dam releases were further constrained to very low levels to lessen downstream sand transport, which would not be consistent with applicable law, it would take between two and three years for these tributaries to resupply the amount of sand lost during the last half of 2011. Compared to the summer of 2002, there was likely about 1.3 million metric tons less sand in Marble and eastern Grand Canyons by the end of December 2011 than there was in 2002. These results, taken in combination with previously published results in the scientific literature, suggest that there is now less sand in Marble and eastern and central Grand Canyons than any time since closure of the dam. Thus, retention of more than 90 percent of the river's natural, upstream sand supply in Lake Powell, in combination with operation of the dam under the MLFF regime (1996 Record of Decision following Glen Canyon Dam operations final EIS) and the 2011 equalization releases (2007 Record of Decision following Coordinated Operations and Shortage Guidelines EIS) has likely resulted in the minimum amount of sand in the Colorado River in Grand Canyon National Park since Glen

Canyon Dam was closed in 1963, at least upstream of about river mile 166. Sand exported from upstream of river mile 240 typically accumulates below that point as part of the Lake Mead delta. Continued monitoring of sand transport and sand storage changes throughout the channel below the dam under future high flow experiments and ongoing daily operations is underway as proposed in the GCMRC's 2012 Science Plan contained in the High-Flow Experimental Protocol EA.

The amount of area in the Colorado River corridor suitable for use by recreational campers continues to decline. The only increases observed in campable area during the past 15-years have occurred as a direct result of high flow experiments, and these increases are generally fairly short lived as newly created sand bars erode under subsequent MLFF operations. Expansion of native riparian vegetation under the MLFF operation appears to be driving additional reductions in campable area. New studies will be initiated in FY2012 to more precisely quantify the rate of recent vegetation encroachment at campsite areas.

Archaeological sites along the Colorado River continue to be subject to erosion, due primarily to rainfall induced run-off creating erosion channels through fine sand terraces (Collins and others, in review). Operations of Glen Canyon Dam have altered aspects of the ecosystem that formerly mitigated rainfall induced erosion, resulting in more and larger gullies than might otherwise be present if the dam were not present or dam operations were further constrained as described above to conserve more of the limited sand supply. Other factors contributing to the erosion of archaeological sites in the river corridor include wind-induced deflation of sediment deposits, incremental soil movement, and trampling by people and animals. The GCMRC is continuing to work with the National Park Service and Reclamation to develop new approaches to monitor changes in archaeological site condition using remote sensing techniques in conjunction with repeated LiDAR measurements of topographic change.

Information presented by the GCMRC staff and its science cooperators at the five 2011 knowledge assessment workshops has been distributed to members of the TWG. An additional knowledge-assessment workshop is planned for January 2012. The GCMRC intends to continue documenting new information in the various resource areas as the 2013-14 biennial monitoring and research plan is developed in 2012.

Socio-Economics

Continuing a process started in FY 2010, in FY 2012, the Socioeconomic Ad Hoc Group (SEAHG) of the Glen Canyon Dam Adaptive Management Program developed a list of recommended socioeconomic studies to be implemented by the GCMRC over the next several years to help inform decisions of the Glen Canyon Dam Adaptive Management Program. In developing this list of proposed studies, the SEAHG considered input provided by an expert panel of economists during a December 2009 workshop. The SEAHG reconfigured some of the panel's original recommendations while also recommending additional studies and approaches. Main recommendations included: (1) complete a hydropower "base case" study for Glen Canyon Dam that can be used for evaluating the financial and economic effects on hydropower production from implementing alternative dam operations; (2) conduct a market-based assessment of economic productivity associated with use of the Colorado River; (3) conduct

studies of the non-market recreational use values associated with the Colorado River corridor; (4) assess the value of the Colorado River to Native American tribes; 5) conduct additional studies to assess the economic value of Glen Canyon Dam hydropower in the context of the western electrical grid; and 6) conduct a comprehensive non use value study for the Colorado River between Glen Canyon Dam and Lake Mead, including associated hydropower and Native American tribal values. In February 2012, the SEAHG's recommendations were forwarded to the Secretary of the Interior, and it is anticipated that at least some of these recommendations will be implemented starting in 2012 in order to provide updated socioeconomic information to Reclamation and the National Park Service for use in the Long Term Experimental and Management Plan Environmental Impact Study. The GCMRC plans to hire an economist in FY 2012 to help with the implementation of future socioeconomic studies.

Tribal Consultation

The GCMRC continued previous efforts to achieve more meaningful consultation with the tribes on science issues related to GCMRC monitoring and other related 2011 work plan activities. These efforts included working with other DOI agencies and the DOI tribal liaison to develop a coordinated protocol for reviewing and responding to tribal input and meeting with tribes to discuss how traditional ecological knowledge may be appropriately integrated with GCMRC's science programs.

Science Support to Department of the Interior Management Agencies

The GCMRC continues to provide information and support for proposed high-flow experimental protocol and non-native fish removal treatments proposed within two EAs completed by the Bureau of Reclamation in December 2011. The GCMRC has also supported development of measures identified by the FWS in the biological opinion on the two EAs. In addition to annual monitoring and research described in the FY 2011-12 biennial work plan, the GCMRC continues to support ongoing needs of Reclamation and the NPS related to the LTEMP EIS currently underway in 2012.

Fish and Wildlife Service

With the release of a final biological opinion on December 23, 2011, the FWS completed ESA Section 7 consultation work associated with the High-Flow Experimental Protocol and Non-Native Fish Control EAs proposed by Reclamation. The FWS will continue with this effort by assisting Reclamation and interested tribes in development of the Memoranda of Understanding in regard to the National Historic Preservation Act and these two proposed actions.

The FWS accepted the opportunity to have cooperating agency status to participate in the Long-Term Experimental and Management Plan for the Glen Canyon Dam EIS on January 4, 2012. The FWS also provided scoping comments on January 18, 2012, and has participated in LTEMP meetings including alternatives development and will continue to be actively engaged in the EIS process. In both the FWS' acceptance of cooperating agency status and scoping comments it continued to recommend that FWCA considerations be incorporated into the EIS planning process in order to adequately assess effects on endangered species, other native fish that are not listed, migratory neotropical songbird use of riparian habitat, waterfowl

and other bird use of wetlands and aquatic habitats, and management of the Lees Ferry trout fishery.

The FWS will continue to provide technical assistance in the development of desired future conditions to support the NPS management work for the Grand Canyon National Park and Glen Canyon National Recreation Area, and continue to participate in the AMWG, its Technical Work Group, and various ad hoc groups and other related assignments.

In 2012, the FWS will conduct up to 8 monitoring trips into the Little Colorado River to generate population estimates for humpback chub and other native fishes, but to also monitor the success of upstream translocations. The FWS will continue to work cooperatively with the NPS and the Havasupai Tribe on monitoring Havasu Creek and completing the second translocation of humpback chub scheduled for spring 2012. Fish will be collected for this translocation effort from the Little Colorado River and held at Dexter NFH&TC until they are large enough to be marked with a small tag. Fish will also be collected to maintain the genetic refuge for humpback chub at Dexter NFH&TC. The FWS will work with the GCMRC to implement a pilot study on collecting small, larval stage humpback chub for use in translocation efforts. The FWS will continue to take the lead on developing a monitoring protocol for effectively sampling the mainstem aggregations of humpback chub and will conduct one sampling trip in fall 2012.

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